

## CLAIMS

1           1. A system for filtering an analog input signal using a digital filter and analog feedback  
2 comprising:

3           a signal combiner for producing an analog output signal based upon an analog  
4           input signal and one or more analog feedback signals, the signal combiner  
5           having at least one input for receiving an analog input signal and the one or  
6           more analog feedback signals, and an output for outputting the analog output  
7           signal;

8           an analog-to-digital converter for converting the analog output signal into a digital  
9           data stream, the converter being communicatively coupled to receive the  
10          analog output signal from the signal combiner;

11          a digital signal processing unit for filtering the digital data stream being  
12          communicatively coupled to receive the digital data stream from the converter  
13          and to send at least one digital output signal to an analog feedback module for  
14          producing the one or more analog feedback signals based on the at least one  
15          digital output signal; and

16          the analog feedback module being communicatively coupled to send the one or  
17          more analog feedback signals to the at least one input of the signal combiner.

1           2. The system of claim 1 wherein the analog-to-digital converter is a sigma-delta  
2 modulator.

1           3. The system of claim 1 wherein the filter is implemented using mixed-signal  
2 complementary metal oxide semiconductor (CMOS).

1           4. The digital signal processing unit of claim 1 further comprising a transfer function unit  
2 for receiving the digital data stream and applying a filter function, the transfer function unit  
3 further comprising:

4                   a first integrator communicatively coupled to receive the digital data stream from  
5                   the converter for generating a first digital output signal; and  
6                   a second integrator communicatively coupled to receive the first digital output  
7                   signal from the first integrator wherein the second integrator generates a  
8                   second digital output signal.

1           5. The digital signal processing unit of claim 4 wherein the first integrator comprises an  
2 up-down counter for generating the first digital output signal as a first carry out signal in two's  
3 complement form and wherein the second integrator comprises an up-down counter for  
4 generating the second digital output signal as a second carry out signal in two's complement  
5 form.

1           6. The digital signal processing unit of claim 5 wherein a first gain module is coupled to  
2 receive the first digital output signal from the first integrator and is also coupled to send the first  
3 digital output signal with a respective gain factor to the analog feedback module wherein the first  
4 gain module is a bit shifter that shifts its respective digital output signal in two's complement  
5 form a number of bits to the left, the number of bits representing the respective gain factor.

1           7. The digital signal processing unit of claim 6 wherein a second gain module is coupled  
2 to receive the second digital output signal from the second integrator and is also coupled to send  
3 the second digital output signal with a respective gain factor to the analog feedback module  
4 wherein the second gain module is a bit shifter that shifts its respective digital output signal in

5 two's complement form a number of bits to the left, the number of bits representing the  
6 respective gain factor.

1 8. The digital signal processing unit of claim 4 wherein the output of the transfer  
2 function is a second order bandpass filtered signal.

1 9. The digital signal processing unit of claim 4 wherein the output of the transfer  
2 function unit is a lowpass filtered signal.

1 10. The analog feedback module of claim 1 further comprising a first digital to analog  
2 converter for converting the first digital output signal to a first analog feedback signal, the first  
3 converter being coupled to receive the first digital output signal and being coupled to send the  
4 first analog feedback signal to the at least one input of the signal combiner.

1 11. The analog feedback module of claim 1 further comprising a second digital to analog  
2 converter for converting the second digital output signal to a second analog feedback signal, the  
3 second converter being coupled to receive the second digital output signal and being coupled to  
4 send the second analog feedback signal to the at least one input of the signal combiner.

1 12. The analog feedback module of claim 10 further comprising a resistance across  
2 which the first analog feedback signal is transferred from the digital to analog converter to the at  
3 least one input of the signal combiner.

1 13. The analog feedback module of claim 12 wherein the resistance is implemented as a  
2 switched capacitance.

1 14. A method for filtering an analog input signal using a digital filter and analog  
2 feedback comprising:

3 producing an analog output signal based upon an analog input signal and one or  
4 more analog feedback signals;

5 converting the analog output signal into a digital data stream;  
6 applying a first digital transfer function to the digital data stream resulting in a  
7 first digital output signal; and  
8 converting the first digital output signal to one of the one or more analog feedback  
9 signals.

10 15. The method of claim 14 further comprises applying a second digital transfer function  
11 to the digital data stream resulting in a second digital output signal.

1 16. The method of claim 14 wherein applying a first digital transfer function to the  
2 digital data stream resulting in a first digital output signal comprises:  
3 applying a second order bandpass filter transfer function.

1 17. The method of claim 15 wherein applying a second digital transfer function to the  
2 digital data stream resulting in a second digital output signal comprises:  
3 applying a lowpass filter transfer function.

1 18. The method of claim 15 wherein applying a first digital transfer function to the  
2 digital data stream resulting in a first digital output signal includes generating the first digital  
3 output signal as a first carry out signal in two's complement form and wherein applying a second  
4 digital transfer function to the digital data stream resulting in a second digital output signal  
5 includes generating the second digital output signal as a second carry out signal in two's  
6 complement form.

1           19. A system for filtering an analog input signal using a digital filter and analog feedback  
2 comprising:

3                   means for producing an analog output signal based upon an analog input signal

4                   and one or more analog feedback signals;

5                   means for converting the analog output signal into a digital data stream;

6                   means for digitally filtering the digital data stream resulting in a first digital

7                   output signal; and

8                   means for converting the first digital output signal to one of the one or more

9                   analog feedback signals.

1           20. The system of claim 19 wherein the means for digitally filtering the digital data  
2 stream of claim 19 further comprises means for applying a filter function being communicatively  
3 coupled to receive the digital data stream, the means for applying a filter function further  
4 comprising

5                   means for generating a first digital output signal being communicatively coupled

6                   to receive the digital data stream from the means for converting,

7                   means for generating a second digital output signal being communicatively

8                   coupled to receive the first digital output signal from the means for generating

9                   a first digital output signal; and

10                  wherein the means for producing the one or more analog feedback signals

11                  comprises means for converting the first digital output signal to a first analog

12                  feedback signal being coupled to receive the first digital output signal and

13                  being coupled to send the first analog feedback signal to the means for

14                  producing an analog output signal, and

15 means for converting the second digital output signal to a second analog feedback  
16 signal being coupled to receive the second digital output signal and being  
17 coupled to send the second analog feedback signal to the means for producing  
18 an analog output signal.